forming a deposited film on a substrate in the vacuum vessel by plasma CVD,

wherein an auxiliary electrode is arranged in plasma in the vacuum vessel, a periodic electric field having a voltage frequency of 1 MHz to 500 MHz and a maximum amplitude of 80V or less is applied to the auxiliary electrode, and only electrons are energized without energizing ions to discompose a hydrogen gas and generate hydrogen radicals, thereby forming a deposited film and controlling the generation of the hydrogen radicals.--

REMARKS

The claims are claims 1-6 and 9-13, with claims 1 and 11-13 being independent. Claims 14-26 have been withdrawn from consideration by the Examiner as directed to a non-elected invention and have been cancelled. Claims 1 and 11-13 have been amended to better define the present invention. Support for this amendment may be found, inter alia, in the specification at page 11, line 22 and page 16, lines 4-5 (a maximum amplitude of 80V or less) and on page 15, line 21 to page 16, line 2 (auxiliary electrode voltage frequency preferably 1 MHz or higher - and upper limit more preferably 500 MHz or lower). No new matter has been added.

Claims 1-6, 9-11 and 13 stand rejected under 35 U.S.C. § 112, second paragraph, as being allegedly indefinite. Applicants have amended claims 1, 11 and 13 to clarify that the frequency of the voltage changes. Withdrawal of this rejection is therefore respectfully requested.

Turning to the objections over the cited prior art, claims 1, 5 and 9-13 stand rejected under 35 U.S.C. § 102(e) as being allegedly anticipated by U.S. Patent No. 6,162,7099 (Raoux). Claims 2-4 and 6 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over U.S. Patent No. 6,162,709 (Raoux). Applicants respectfully traverse the grounds of rejection.

Prior to addressing the merits of rejection, Applicants would like to briefly discuss some of the key features and advantages of the presently claimed invention. The present invention is directed to a method for depositing a film in which high frequency electric power of 1 MHz to 200 MHz is applied to the discharge electrode and a periodically changing voltage having a frequency from 1 MHz to 500 MHz and a maximum amplitude of 80V or less is applied to the auxiliary electrode, which is located in the plasma stream. This change in voltage or application of the periodic electric field is such that it results in the efficient and controlled formation of hydrogen radicals from hydrogen gas and does not cause the auxiliary electrode to discharge. As shown in Table 1, where the frequency of the potential applied to the auxiliary electrode was 1 MHz and the voltage amplitude 35V, then, as seen in Table 2, excellent results are obtained.

In Raoux in column 16, lines 66-67; column 19, line 34; column 20,lines 56-66; Comparative Examples 1 and 2 and Examples 1-4, the frequency for controlling ion bombardment is preferably < 400 kHz to get better film integrity (column 20, line 59). Best results were obtained at 50-220 kHz, with 50 kHz the most preferred frequency (see column 20, lines 56-66). In Example 4, the Rf power was also 50 kHz. To the contrary, in the present claimed invention the frequency applied to the auxiliary electrode is 1 MHz to

500 MHz. Raoux, therefore, teaches a much lower range and fails to suggest the higher range.

The Amendment should be entered because it responds to a new reference, Raoux, cited for the first time, it reduces the issues, places the case in better form for appeal and places the claims in allowable form.

Therefore, Applicants respectfully request that all objections and rejections be withdrawn, the claims allowed and the case passed to issue.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

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VERSION WITH MARKINGS SHOWING THE CHANGES MADE

1. (Twice Amended) A deposited-film formation method comprising the steps of:

providing a discharge electrode in a vacuum vessel equipped with exhaust means;

supplying a hydrogen gas and a raw material gas for forming a deposited film which contains at least an Si element;

generating plasma from the material gas by supplying high frequency electric power of 1 MHz to 200 MHz to the discharge electrode; and

forming a deposited film on a substrate in the vacuum vessel by plasma CVD,

wherein an auxiliary electrode is arranged in plasma in the vacuum vessel, and a periodically changing voltage having a voltage frequency of [100 kHz to 5 GHz] 1 MHz to 500 MHz and a maximum amplitude of 80V or less is applied to the auxiliary electrode [without causing a discharge] to form a deposited film while controlling generation of hydrogen radicals.

11. (Twice Amended) A deposited-film formation method comprising the steps of:

providing a discharge electrode in a vacuum vessel equipped with exhaust means;

supplying a hydrogen gas and a raw material gas for forming a deposited film which contains at least an Si element;

generating plasma from the material gas by supplying high frequency electric power of 1 MHz to 200 MHz to the discharge electrode; and

forming a deposited film on a substrate in the vacuum vessel by plasma CVD,

wherein an auxiliary electrode is arranged in plasma in the vacuum vessel, a periodically changing voltage having a voltage frequency of [100 kHz to 5 Ghz] 1 MHz to 500 MHz and maximum amplitude of 80V or less is applied to the auxiliary electrode so that a voltage lower than the potential of plasma from the material gas is applied only in a certain period in at least one cycle of the periodically changing voltage, thereby forming a deposited film and controlling generation of hydrogen radicals.

12. (Twice Amended) A deposited-film formation method comprising the steps of:

providing a discharge electrode in a vacuum vessel equipped with exhaust means;

supplying a hydrogen gas and a raw material gas for forming a deposited film which contains at least an Si element;

generating plasma from the material gas by supplying high frequency electric power to the discharge electrode; and

forming a deposited film on a substrate in the vacuum vessel by plasma CVD,

wherein an auxiliary electrode is arranged in plasma in the vacuum vessel, a high-frequency power of 1 MHz to 200 MHz is applied to the discharge electrode, and a high-frequency power of [100 kHz to 5 MHz] 1 MHz to 500 MHz and a maximum amplitude of 80V or less is applied to the auxiliary electrode, thereby forming a deposited film and controlling generation of hydrogen radicals.

13. (Twice Amended) A deposited-film formation method comprising the steps of:

providing a discharge electrode in a vacuum vessel equipped with exhaust means;

supplying a hydrogen gas and a raw material gas for forming a deposited film which contains at least an Si element;

generating plasma from the material gas by supplying high frequency electric power of 1 MHz to 200 MHz to the discharge electrode; and

forming a deposited film on a substrate in the vacuum vessel by plasma CVD,

wherein an auxiliary electrode is arranged in plasma in the vacuum vessel, a periodic electric field having a voltage frequency of [100 kHz to 5 Ghz] 1 MHz to 500 MHz and a maximum amplitude of 80V or less is applied to the auxiliary electrode, and only electrons are energized without energizing ions to discompose a hydrogen gas and generate hydrogen radicals, thereby forming a deposited film and controlling the generation of the hydrogen radicals.